PREDICTORS OF MEDICATION ADHERENCE USING MULTI-DIMENSIONAL ADHERENCE MODELS IN BREAST CANCER PATIENTS IN NORTH KERALA.

SYNOPSIS

Of the thesis for the award of Degree of

DOCTOR OF PHILOSOPHY

In

MEDICINE

Submitted to

SRI BALAJI VIDYAPEETH UNIVERSITY

PUDUCHERRY

Mrs. RESHMA V

Assistant Professor, Department of Pharmacology, SSSMCRI, Chennai

Under the Guidance of

Dr. A Maduram

Professor & Head, Dept. of Pharmacology, SSSMCRI, Chennai

Tamilnadu, India

Co- Guide

Dr Narayanan Kutty Warrier

Medical Director, Medical Oncologist, MVR Cancer & Research Institute

Kozhikode-Kerala

PREDICTORS OF MEDICATION ADHERENCE USING MULTI-DIMENSIONAL ADHERENCE MODELS IN BREAST CANCER PATIENTS IN NORTH KERALA

SYNOPSIS

1. Introduction

Medication adherence involves the active participation and collaboration of the patient in the treatment process. It is defined as the extent to which a patient follows the prescribed interval and dose of a dosing regimen. In simpler terms, adherence is the degree to which the patient takes medication as prescribed.

Importance of Medication Adherence

1. Effectiveness of Treatment: Adherence ensures that patients receive the full therapeutic benefits of their medications, which maximizes their effectiveness in managing symptoms, controlling diseases, preventing complications, and promoting overall health.

2. Disease Management and Control: Adherence is critical for managing chronic conditions such as diabetes, hypertension, asthma, HIV/AIDS, and mental health disorders. It helps control symptoms, stabilize disease progression, prevent exacerbations, and improve long-term outcomes.

3. Prevention of Disease Progression: Adherence is essential for preventing disease progression and reducing the risk of complications and adverse events, such as in

cardiovascular disease and cancer.

4. Reduction of Healthcare Costs: Adherence can lead to cost savings by reducing the need for hospitalizations, emergency department visits, and expensive medical interventions.

5. Enhancement of Quality of Life: Adherence improves the quality of life by alleviating symptoms, improving physical functioning, and enabling patients to engage in daily activities.

6. Public Health Impact: Improved adherence rates can lead to better control of infectious diseases, reduced disease transmission, and improved overall population health outcomes.

7. Promotion of Patient Safety: Adherence minimizes the risk of medication errors, drug interactions, and adverse drug reactions, ensuring the safe use of medications.

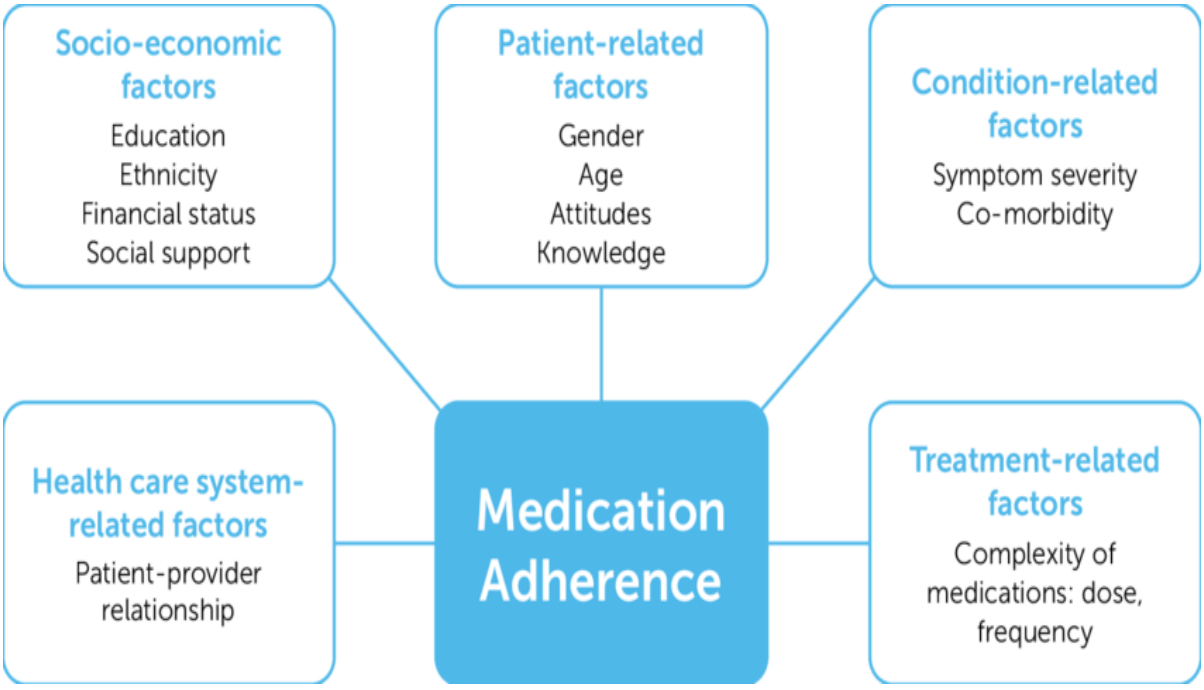

Figure 1. Factors contributing to adherence

Medication Adherence Theories

1. Health Belief Model (HBM): Suggests that adherence is more likely if individuals believe they are susceptible to a condition, the condition is severe, the benefits of medication outweigh the costs, and there are few barriers to adherence.

2. Theory of Planned Behavior (TPB): Posits that adherence is influenced by attitude toward the behavior, subjective norms, and perceived behavioral control.

3. Social Cognitive Theory (SCT): Emphasizes the role of social influences and self-efficacy in adherence.

4. Self-Regulation Model (SRM): Focuses on perceptions of illness severity, susceptibility, personal control, and emotional response.

5. Transactional Model of Stress and Coping (TMSC): Suggests adherence is influenced by stress appraisal and coping mechanisms.

6. Common-Sense Model of Self-Regulation (CSM): Proposes that cognitive representations of illness and treatment influence adherence.

7. Information-Motivation-Behavioral Skills Model (IMB): Suggests that accurate information, motivation, and behavioral skills are necessary for adherence.

Non-Adherence

Non-adherence occurs when patients do not take their medications as prescribed or discontinue treatment early. It is categorized into:

- Primary Non-Adherence (PNA): Failure to fill the first and successive prescriptions.

- Secondary Non-Adherence (SNA): Failure to take prescribed medication as directed after the first prescription is filled.

Consequences of Non-Adherence

1. Disease Progression: Worsening or progression of the underlying condition.

2. Complications and Hospitalizations: Increased risk of complications, leading to hospitalizations or emergency medical care.

3. Reduced Quality of Life: Significant impact on quality of life due to untreated or poorly managed conditions.

4. Increased Healthcare Costs: More frequent medical visits, emergency department visits, and hospitalizations increase healthcare costs.

5. Mortality: Increased risk of mortality due to untreated or poorly managed chronic conditions.

Non-adherence rates in various conditions, including breast cancer, range from 25% to 50%, significantly increasing the risk of mortality and recurrence. Factors influencing adherence include socioeconomic status, healthcare system, disease, treatments, and patient-related factors such as depression. Addressing depression and other barriers through multidisciplinary approaches can improve adherence and patient outcomes.

Determinants of adherence

In 2003, the World Health Organization (WHO) identified five key factors that

influence adherence to long-term medications: socioeconomic, patient-related, condition-related, therapy-related, and health system-related factors. Socioeconomic factors such as income, access to healthcare, insurance, and medication affordability play a significant role. Health literacy is crucial, as limited understanding of medication instructions and the importance of adherence can hinder patient compliance. The complexity of a medication regimen, including the number of medications and administration instructions, also impacts adherence, with simpler regimens generally improving adherence rates. Patients' perceptions of the benefits and risks of medications, including efficacy and side effects, can affect their willingness to adhere to treatment. Adverse effects from medications may lead patients to modify or discontinue their treatment.

Effective patient-provider communication is vital for promoting adherence by enhancing understanding and motivation. Social support from family, caregivers, or support groups can positively influence adherence through encouragement and reminders. Cultural beliefs and attitudes towards illness and treatment also play a role in medication adherence. Barriers to accessing healthcare services, such as transportation issues and long wait times, can impact adherence, while psychological factors like depression and stress can also affect compliance. Treatment duration and continuity are crucial, as adherence may decline over time, particularly for long-term treatments. Additionally, health system factors, including medication costs, insurance coverage, and healthcare policies, significantly impact adherence.

Cancer is a group of diseases characterized by uncontrolled cell growth that can form tumors and spread (metastasize) to other parts of the body. Metastasis complicates

treatment and often leads to mortality. In 2018, there were 18.1 million cancer cases worldwide, with numbers expected to rise to 29.7 million by 2040. Breast cancer emerged as the most frequently diagnosed cancer in 2022.

Breast cancer is the most commonly diagnosed cancer among women globally, with over 2 million new cases in 2020. In India, breast cancer has a prevalence rate of 25.8 per 100,000 people and is the leading cancer among women, with significant socio-economic impacts. The high incidence of breast cancer underscores the importance of early detection and effective treatment to reduce mortality.

Breast cancer can be classified based on histological types, such as Ductal Carcinoma In Situ (DCIS), Invasive Ductal Carcinoma (IDC), Lobular Carcinoma In Situ (LCIS), and Invasive Lobular Carcinoma (ILC). Molecular classifications include hormone receptor status (ER, PR), HER2 status, and Triple-Negative Breast Cancer (TNBC). Clinically, it includes Inflammatory Breast Cancer (IBC) and metastatic breast cancer. The TNM system is commonly used for staging, while genetic classifications focus on BRCA1 and BRCA2 mutations. Breast cancer is also graded based on cell appearance and classified into molecular subtypes like Luminal A, Luminal B, HER2-enriched, and Basal-like.

Treatment for breast cancer involves a combination of modalities. Surgery includes options such as lumpectomy, mastectomy, sentinel lymph node biopsy, and breast reconstruction. Hormonal therapy, which targets hormone receptor-positive cancers, includes SERMs, Aromatase Inhibitors, SERDs, and LHRH Agonists. Chemotherapy may be used as adjuvant or neoadjuvant therapy with various agents, including anthracyclines, taxanes, and alkylating agents. Targeted therapy involves drugs that

specifically target molecules or pathways involved in cancer growth, such as HER2-targeted therapies, CDK4/6 inhibitors, PI3K inhibitors, and PARP inhibitors. Radiation therapy, often used after breast-conserving surgery, has evolved to include whole breast irradiation and partial breast irradiation, offering patients reduced treatment duration and improved outcomes. The choice of treatment should be tailored to individual patient and tumor characteristics to achieve the best results.

WHO Objectives: Global Breast Cancer Initiative

The World Health Organization (WHO) has launched the Global Breast Cancer Initiative (GBCI) to tackle the rising global burden of breast cancer. This initiative sets ambitious objectives to significantly reduce breast cancer mortality rates and enhance outcomes globally. The GBCI aims to decrease global breast cancer mortality by 2.5% annually, targeting a 25% reduction by 2030 and a 40% reduction by 2040.

To achieve this, the initiative has outlined several key objectives. First, reducing global mortality rates is a primary goal. The GBCI aims for a 2.5% annual reduction in breast cancer deaths, with specific targets of a 25% reduction by 2030 and a 40% reduction by 2040. These targets highlight the urgent need for improved survival rates through early detection, effective treatments, and strengthened health systems.

The second objective is to improve early detection and diagnosis. The GBCI seeks to increase the detection of breast cancer at earlier stages, which allows for more effective treatment. By expanding screening programs, enhancing diagnostic services, and educating healthcare professionals and the public, the initiative aims to boost early diagnosis and reduce mortality.

Enhancing access to comprehensive treatment is the third objective. The GBCI focuses on ensuring equitable access to all types of breast cancer treatments, including surgery, chemotherapy, radiation, and targeted therapies. Addressing barriers such as high treatment costs and inadequate healthcare infrastructure is crucial for improving patient outcomes and survival rates.

The fourth objective is to build health system capacity. Strengthening National Health Systems to provide effective breast cancer care from prevention and early detection to treatment and palliative care. This involves improving healthcare infrastructure, ensuring the availability of essential medicines and equipments, and training healthcare professionals to deliver high-quality care.

The final objective is to increase public awareness about breast cancer. The GBCI emphasizes the importance of educating the public about breast cancer risks, symptoms, and the benefits of early detection. Through community-based campaigns and educational programs, the initiative aims to promote preventive health behaviors and encourage early diagnosis.

Non-adherence to breast cancer treatment can significantly impact patient outcomes. Failure to follow prescribed regimens, including chemotherapy, hormonal therapy, or targeted therapy, can reduce treatment effectiveness, increase disease progression, and worsen overall outcomes. Non-adherence may also contribute to treatment resistance, psychosocial issues, and higher healthcare costs.

Several factors contribute to non-adherence. These include side effects of treatment, complex regimens, financial constraints, logistical challenges, psychological distress,

lack of social support, limited health literacy, communication barriers, treatment fatigue, and medical co morbidities. Additionally, factors such as age, educational level, menopausal status, marital status, and prior medication experiences also influence adherence.

Condition-related factors like tumor size, lymph node involvement, and tumor grade can further impact adherence. Larger tumors and advanced stages often require more intensive treatments, which can increase side effects and complicate adherence. Psychological factors, including depression and anxiety, can also affect adherence by impairing cognitive function and communication with healthcare providers.

To assess medication adherence, various indicators are used. Objective measures include prescription refill records, medication possession ratio (MPR), proportion of days covered (PDC), and electronic monitoring devices. Self-reported measures, pharmacy claims data, and biological markers also provide insights into adherence. Mobile health apps and electronic health interventions offer additional tools for managing adherence, though challenges such as long treatment durations and side effects persist. Understanding and addressing the predictors of medication adherence in breast cancer patients is crucial for improving treatment outcomes and patient care.

Need of the study

The need for this study arises from the prevalent issue of poor medication adherence among patients, despite increased awareness of its significance. Research indicates that approximately more than 50% of patients fail to follow prescribed medications, regardless of their diagnosis. This non-adherence undermines the effectiveness of

treatments, leading to unnecessary morbidity and mortality, and poses challenges for both healthcare providers and patients.

In breast cancer patients, non-adherence to medications such as hormonal therapy or chemotherapy can severely impact disease progression and survival rates. Poor adherence can result in suboptimal treatment outcomes, higher risk of disease recurrence, and increased healthcare utilization, including hospitalizations and emergency visits. However, there is limited evidence specifically addressing the consequences of non-adherence in breast cancer care.

To bridge this knowledge gap, further research is needed to examine the effects of medication non-adherence on clinical outcomes such as disease recurrence, progression-free survival, and overall survival. Identifying factors contributing to non-adherence, including patient-related, treatment-related, and healthcare system-related factors, will help in developing targeted interventions to improve adherence and enhance treatment effectiveness.

Understanding and addressing non-adherence in breast cancer patients is critical for optimizing treatment outcomes, reducing disease burden, and improving patient well-being. This study aims to assess whether patients require more information and support and to identify factors influencing medication adherence based on the multidimensional adherence model. The findings will inform strategies for increasing patient education, implementing nurse-led programs, and utilizing digital health applications to improve adherence rates in breast cancer patients.

2. Aim and Objectives

Background of the study

The study is necessitated by the significant problem of poor medication adherence, with approximately 50% of patients failing to adhere to prescribed treatments. This non-adherence leads to adverse health outcomes, including disease progression, increased complications, and higher mortality rates. For breast cancer patients, the need is even more pressing due to the potential consequences of non-adherence, such as suboptimal treatment efficacy, disease recurrence, and increased healthcare costs. Research in this area is crucial for understanding and addressing the factors influencing medication adherence in this patient population.

Aim

To assess the level of medication adherence in breast cancer patients in the northern region of Kerala and understand the factors influencing it, with the goal of improving adherence rates and patient outcomes.

Objectives

Primary Objectives:-

- To assess the level of medication adherence in breast cancer patients
- To identify the factors that influence medication adherence in breast cancer patients.
- To assess the potential of digital interventions in enhancing medication adherence.

Secondary Objectives

- To find out the impact of interventions in improving the effectiveness of medication adherence in breast cancer patients.

3. Review of Literature

GLOBOCAN 2020 reported 19.3 million new cancer cases and nearly 10 million deaths globally. Breast cancer became the most diagnosed cancer, surpassing lung cancer, which remains the leading cause of cancer mortality. There are notable disparities in cancer incidence and mortality between transitioned and transitioning countries. By 2040, the global cancer burden is expected to rise to 28.4 million cases, highlighting the need for better cancer prevention and care infrastructure in transitioning countries.

Fitzmaurice et al. (2017) highlighted a 33% increase in cancer incidence from 2005 to 2015, mainly due to aging populations and growth. Despite increased incidence, age-standardized death rates decreased in most countries, indicating advancements in cancer management. The study emphasized the need for global cancer control strategies focusing on prevention, early detection, and effective treatment. Malvia et al. (2017) reported breast cancer as the leading cancer among Indian women, with significant urban-rural disparities in incidence and mortality. Younger age is a significant risk factor, with projections suggesting a substantial rise in cases by 2020. The study underscores the importance of enhanced health awareness, screening programs, and treatment facilities in India.

Cramer et al. (2008) distinguished between "compliance" (following prescribed medication regimens) and "persistence" (duration of treatment). Understanding both is

crucial for accurate medication usage patterns. Kulkarni et al. (2017) found high compliance rates in breast cancer screening and referrals in urban Indian slums, influenced by literacy and cultural factors. The study highlights the need for culturally sensitive health interventions to improve screening uptake and outcomes. Van den Brandt and Schulpen (2017) found that high adherence to the Mediterranean Diet significantly reduced the risk of estrogen receptor-negative breast cancer in postmenopausal women. The study advocates for public health initiatives promoting dietary patterns to mitigate breast cancer risk.

Abderrahman (2017) highlighted medication non-adherence in breast cancer prevention and treatment due to side effects, psychological factors, and misconceptions. The review emphasizes the need for improved patient education and communication to enhance treatment outcomes. Santorelli et al. (2017) noted a decrease in adherence to diabetes medication among older women with breast cancer, highlighting the need for targeted interventions to support medication adherence among patients managing multiple chronic conditions. Lehrnbecher et al. (2017) found variable compliance rates among pediatric oncology patients for preventive anti-infective measures. The study underscores the need for tailored interventions to improve adherence and reduce infections.

Al-Hassany et al. (2017) reviewed methods for measuring medication adherence in chronically ill children, recommending a multi-method approach for the most accurate assessment to develop effective interventions. Costa et al. (2017) reviewed strategies to improve medication adherence, noting that multifaceted approaches combining educational, behavioral, and technological interventions show the most promise,

especially for older adults. Foulon et al. (2017) emphasized the challenges of adherence to oral anticancer medications, advocating for enhanced patient education and multidisciplinary support to improve adherence rates.

Geynisman and Wickersham (2017) reviewed adherence to oral anticancer medications, identifying barriers and highlighting the need for effective strategies to support patients in managing their treatment. Shankar et al. (2017) explored the use of a modified medication adherence scale in hypertensive patients, finding better adherence among males and those on monotherapy. The study highlights the importance of simple, effective tools for monitoring adherence. Wilhelmsen and Eriksson (2017) reviewed various healthcare interventions to improve medication adherence, emphasizing the need for personalized approaches and further research to enhance intervention effectiveness.

Sankar et al. (2017) found high rates of poor medication adherence among diabetic patients in rural Kerala, highlighting the need for comprehensive interventions to improve adherence through education and support. Bhandari et al. (2017) reported a 73% adherence rate to antihypertensive treatment in Kolkata's urban slums, identifying socioeconomic factors as significant predictors. The study suggests improving access to healthcare and medication affordability to enhance adherence. Sharma et al. (2017) reviewed interventions to improve medication adherence in patients with multimorbid conditions, highlighting the need for tailored strategies considering the complexity of managing multiple chronic conditions.

Kumar et al. (2017) emphasized the importance of adherence to chemotherapy and supportive therapy to minimize adverse drug reactions in cancer patients. The study

underscores the role of oncology pharmacists and healthcare teams in fostering adherence. Foster et al. (2017) assessed guideline adherence among US oncologists in managing early breast cancer, identifying areas for improvement in clinical practice and patient care. Bender et al. (2017) identified factors influencing adherence to adjuvant endocrine therapy in breast cancer patients, highlighting the impact of mood and financial hardship. The study emphasizes the role of oncology nurses in improving adherence. Claros et al. (2017) reviewed scales for assessing oral pharmacological adherence in oncology patients, recommending the Adherence Determinants Questionnaire and the Oral Chemotherapy Adherence Scale for reliable measurement.

DiBonaventura et al. (2017) explored patient preferences and treatment adherence in metastatic breast cancer, emphasizing the importance of aligning treatment attributes with patient preferences to improve adherence. Miasso et al. (2017) found a strong association between depressive symptoms and lower adherence to chemotherapy in breast cancer patients, highlighting the need for integrated care approaches addressing psychological health. Hurtado-de-Mendoza et al. (2017) reviewed behavioral interventions to enhance adherence to hormonal therapy in breast cancer survivors, finding current interventions insufficient and calling for innovative strategies to address adherence barriers.

4. Methodology

This cross-sectional study assessed the predictors of medication adherence in breast cancer patients. The study was conducted at the esteemed Tertiary Care Cancer Hospital and Research Institute in North Kerala, which offered a holistic approach to cancer care encompassing prevention, diagnosis, treatment, and research. The study

spanned two years to allow for comprehensive data collection and longitudinal assessments of adherence patterns and treatment outcomes.

Study Participants

The study cohort consisted of female breast cancer patients on oral medication, recruited from the medical oncology outpatient department (OPD) of the Tertiary Care Cancer Hospital and Research Institute in North Kerala, using purposive sampling techniques. Inclusion criteria included women aged 18 years and above, diagnosed with breast cancer, currently undergoing treatment (surgery, chemotherapy, hormonal therapy, targeted therapy, radiation therapy), and able to provide informed consent. Exclusion criteria were patients with cognitive impairments that hindered understanding and response, and those not willing to participate.

Sample Size

A sample size of 200 patients was selected based on statistical power calculations. The sample size calculation followed the formula $n = (Z_{\alpha/2})^2 * p * q / d^2$, where $Z_{\alpha/2}$ was 1.96 for a two-tailed test, p was the prevalence of adherence (0.58), q was 1 - p (0.42), and d was the absolute error (0.05). Substituting these values, we got $n = (1.96)^2 * 0.58 * 0.42 / (0.05)^2 = 192$. The sample size was rounded to 200 to enhance statistical robustness and accommodate potential data loss.

Study Design

The research adopted a Cross sectional survey design, enabling systematic observation of a group of breast cancer patients over time. This approach facilitated the longitudinal examination of medication adherence behaviors and their impact on

treatment outcomes. The study also explored the efficacy of digital interventions in enhancing medication adherence.

Methodology Steps

1**. Development of Questionnaire:** A comprehensive questionnaire was developed, incorporating validated instruments such as the Medication Adherence Rating Scale (MARS) and the Clinicians Rating Scale (CRS). The questionnaire covered demographic information, treatment details, and factors influencing adherence.

2. Validation of Questionnaire: The questionnaire was pre-tested on a small sample of breast cancer patients to ensure clarity, relevance, and reliability. Feedback was used to refine the questionnaire before full-scale administration.

3. Sample Size Calculation: A sample size calculation was conducted to determine the number of participants required to achieve statistically significant results. The target sample size was based on the prevalence of breast cancer, expected adherence rates, and the number of predictors being analyzed.

4. Data Collection: Data was collected through structured questionnaires and medical records review. The instruments used included the Medication Adherence Rating Scale (MARS), a self-report questionnaire to measure adherence behavior and beliefs, and the Clinicians Rating Scale (CRS), an assessment tool used by healthcare professionals to evaluate patient adherence and behavior. Prescription refill records provided objective data on medication adherence by tracking prescription refill patterns, and electronic monitoring devices tracked real-time medication usage.

5. Administration of Questionnaire: The questionnaire was administered during

routine clinic visits or via telephone interviews to ensure a high response rate. Participants were given sufficient time to complete the questionnaire, and assistance was provided if needed.

6. Variables: The dependent variable was medication adherence, while independent variables included socioeconomic factors, patient-related factors (age, education, menopausal status, marital status, comorbidities), condition-related factors (tumor size, lymph node involvement, tumor grade), therapy-related factors (treatment complexity, side effects), and health system-related factors (patient-provider communication, access to healthcare services).

7. Data Analysis: Data analysis involved descriptive statistics to summarize patient demographics and adherence levels, logistic regression to identify predictors of medication adherence, and analysis of variance (ANOVA) to examine differences in adherence based on patient and treatment characteristics. The level of medication adherence was presented as Mean ± SD. Percentages of adherent and non-adherent patients were computed. The mean scores were compared using the Independent T-test. The association between various factors and medication adherence was assessed using the Chi-square test. Multiple logistic regressions was employed to estimate the degree of variation these factors contributed to adherence.

8. Ethical Considerations: Ethical considerations included obtaining informed consent from all participants, maintaining confidentiality and anonymity of participants, and seeking ethical approval from the relevant institutional review boards.

5. Results and Discussion

Results

The study provided a comprehensive overview of the factors influencing medication adherence among breast cancer patients. Key findings are summarized as follows:

Demographic Characteristics:

The participants' ages ranged from 31 to 68 years, with a mean age of 49.38 years and a standard deviation of 9.13. Among the participants, 56.5% belonged to nuclear families, while 43.5% were from joint families. About 37.5% of participants reported being employed, while 62.5% were unemployed. This distribution suggested that breast cancer diagnosis and treatment impacted employment status due to treatment-related side effects or care giving responsibilities. The educational background of participants varied, with 32.0% holding a degree, 46.5% completing schooling, and smaller percentages having primary education, high school diplomas, or other qualifications.

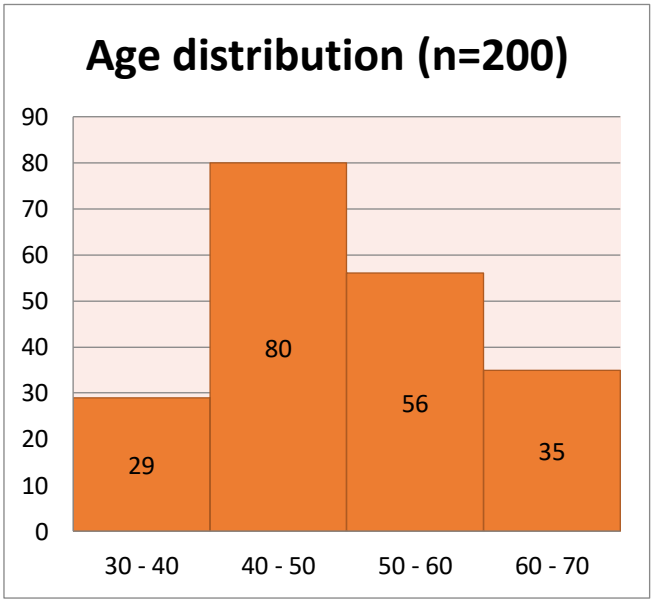

Figure 2. Age distribution

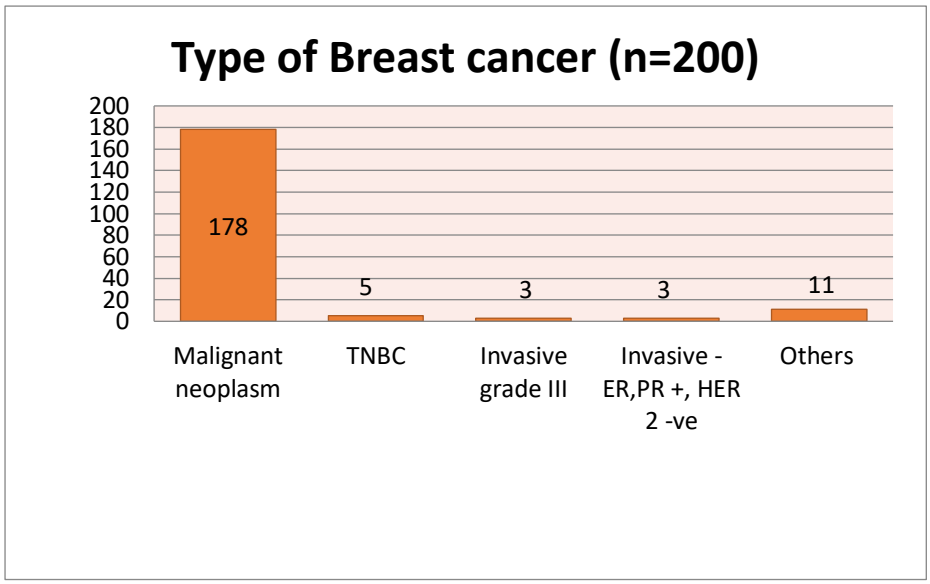

Figure 2.Type of Breast cancer

Health and Treatment-Related Findings:

A significant majority (61.5%) of participants experienced delayed menstruation following surgery or treatment, while 36.5% were in menopause. 38.5% underwent menopause as a result of cancer treatment, while 61.5% experienced natural menopause. The majority of participants (89.0%) had malignant neoplasms, with smaller percentages having triple-negative breast cancer (2.5%), invasive grade III cancer (1.5%), or other types (5.5%). All participants underwent breast conservation surgery, wide excision, and axillary clearance as part of their treatment regimen. A substantial majority (98.5%) reported experiencing symptoms related to their breast cancer diagnosis or treatment. 61.0% of participants were self-diagnosed, while 39.0% did not specify the method of diagnosis.

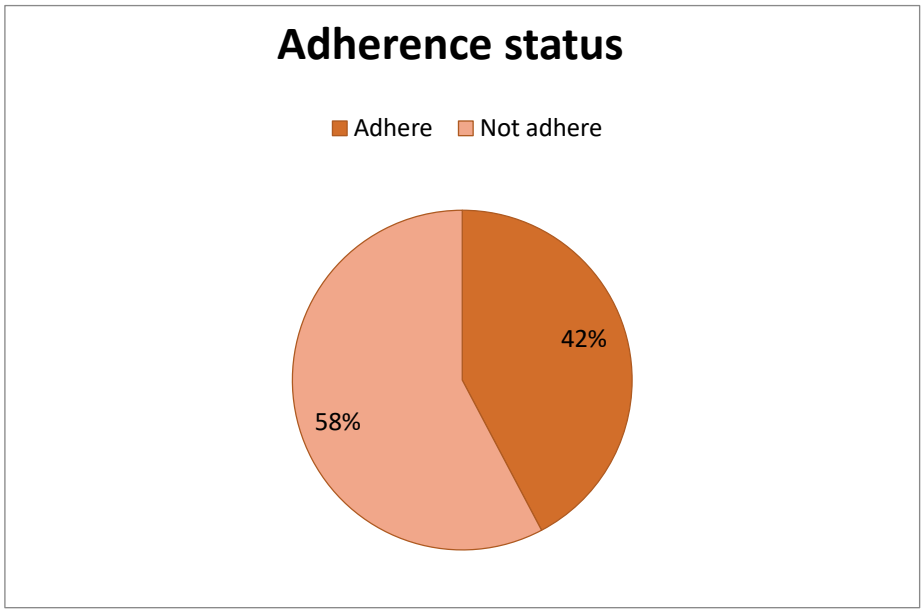

Figure 3.Adherence status

Adherence and Influencing Factors:

41.0% of participants adhered to their treatment regimen, while 59.0% did not. This indicated a significant challenge in ensuring medication adherence among breast cancer patients. While 55.5% of participants took their medication while traveling, a significant proportion (44.5%) did not. This suggested that travel could disrupt medication routines and adherence behaviors. All participants faced treatment expenses, indicating the financial burden associated with cancer care. A majority (65.5%) considered stopping treatment due to cost-related concerns. The majority of participants (87.5%) were accompanied by family members or caregivers during their hospital visits, indicating strong familial support. However, 12.5% attended appointments alone. 65.5% of participants reported feeling sad following their breast cancer diagnosis, while 34.5% felt sad but believed they could overcome it. Family reactions mirrored this, with 65.5% feeling sad and 34.5% feeling sad with sympathy.

Factors affecting adherence

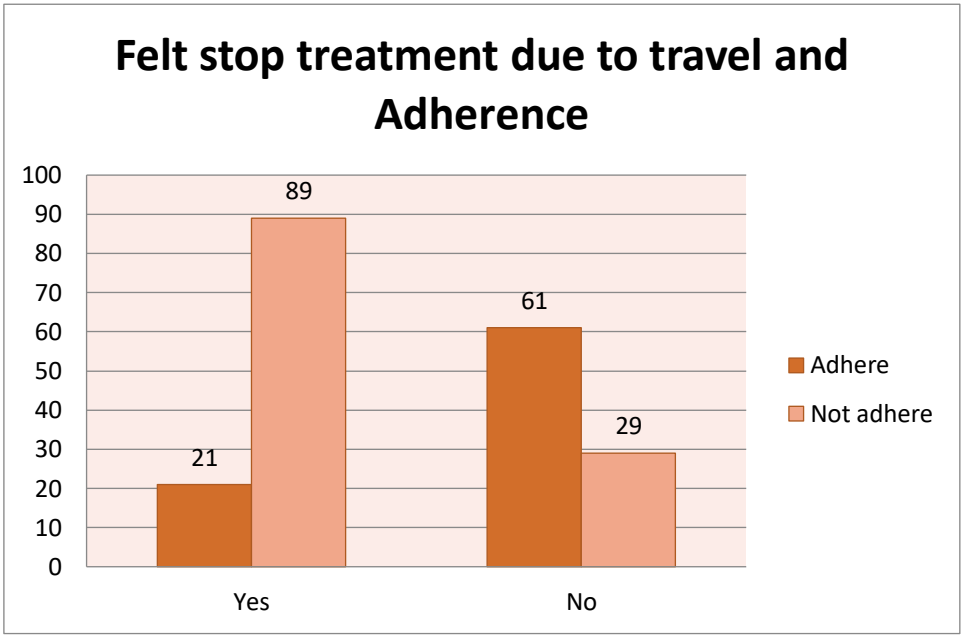

Figure 4. Felt stop treatment due to travel and adherence

\

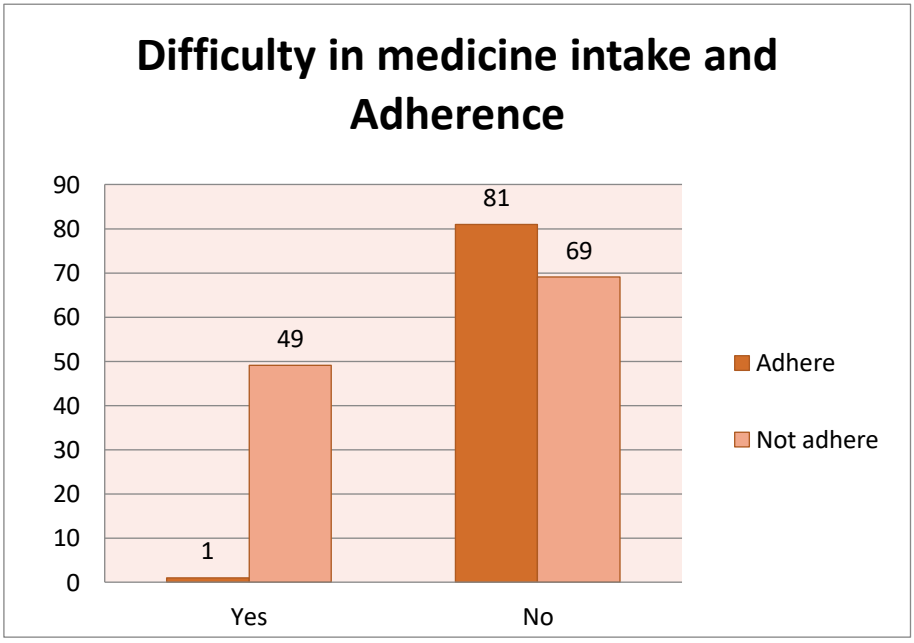

Figure 5. Difficulty in medicine intake and adherence

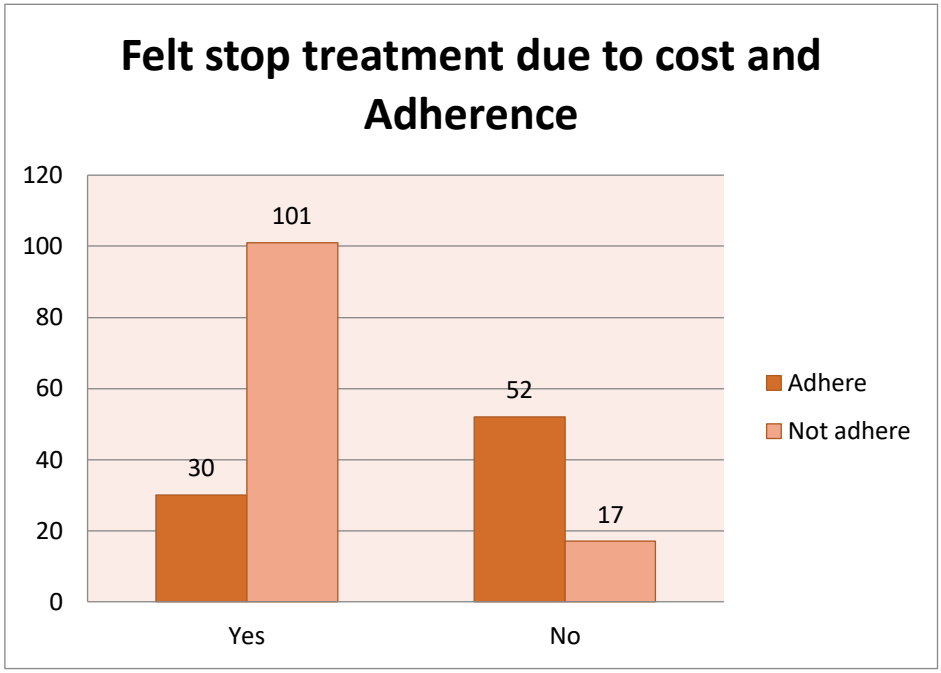

Figure 12.Felt stop treatment due to cost and adherence

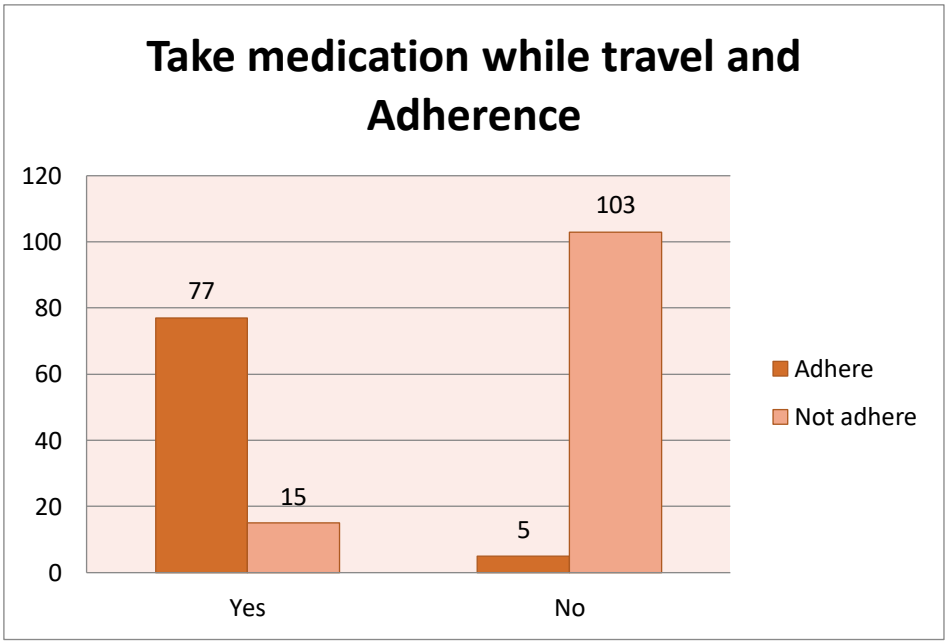

Figure 13. Take medication while travel and adherence

Statistical Analysis:

Significant associations with adherence were found for several factors: Differences in adherence rates were observed between treatment systems (p=0.001). Patients relying on themselves for medication reminders were less likely to adhere (p=0.008). The need

to travel significantly impacted adherence (p=0.001). Stopping treatment due to cost (p=0.001) or travel (p=0.001) showed significant associations with adherence. Patients facing difficulty in taking medicine were less likely to adhere (p=0.001). Other variables did not show significant associations with adherence (p-values > 0.05). Travel cost, treatment cost, and treatment location were significant predictors of adherence, explaining 63.9% of the variability in adherence. The odds of non-adherence were 11.701 times higher for those considering stopping treatment due to travel costs and 12.752 times higher for those considering stopping due to treatment costs.

Additional Insights:

The majority (74.5%) received treatment at other healthcare facilities in addition to the study site. 57.5% preferred less spicy foods, while 39.0% preferred spicy foods. Most participants (72.0%) were unsure about specific foods to avoid during cancer treatment. The majority (91.0%) reported not using tobacco products, while 9.0% did. While 25.0% engaged in physical activity, 75.0% did not. About half (47.5%) received instructions regarding physical activity from healthcare providers. Participants reported an average of 5.72 family members supporting them, with the number ranging from 3 to 12. A majority (90.0%) did not miss follow-up appointments, while 10.0% did. All participants reported that family members and relatives bore the financial responsibility for treatment costs.

The study highlighted significant challenges and predictors related to medication adherence among breast cancer patients. Addressing financial, logistical, and support-related barriers was essential for improving adherence rates and patient

outcomes. Tailored interventions targeting these factors were crucial for enhancing treatment adherence and overall patient well-being.

6. Discussion

The age distribution of breast cancer patients showed most cases in women aged 50 and older. Granular age categorization (e.g., 30-40 years, 40-50 years) enhanced understanding of age-related trends, aiding early detection strategies. Analyzing family type and treatment adherence revealed no significant association, suggesting that individual factors, personal motivation, healthcare access, and supportive environments played crucial roles in adherence. Approximately 37.5% of participants were employed, while 62.5% were unemployed, highlighting the impact of breast cancer on employment status. Further research is needed to explore factors affecting employment, considering disease severity, support systems and workplace accommodations. Educational level influenced health literacy and treatment decisions, but no significant association between education level and adherence was found, indicating complex interactions of socioeconomic factors and health behaviors.

Family support was crucial for emotional and practical assistance during treatment. Treatment-induced menopause required adequate support for survivors' reproductive health. The low rate of regular breast self-examinations (5.0%) underscored the need for patient education on early detection practices. Self-detection of breast abnormalities necessitated improved access to diagnostic services and patient education.

Symptoms like fatigue, pain, and psychological distress significantly impacted survivors' quality of life, making comprehensive symptom management essential.

Supportive interventions, including counseling and peer support, were necessary for addressing emotional distress. Coordinated care and communication were essential for seamless continuity and optimized outcomes. Integrative cancer care models combining conventional and complementary therapies could address patients' holistic needs.

Healthcare professionals' guidance was indispensable for encouraging healthy behaviors. Personalized advice on diet, exercise, and stress management was essential for preventing recurrence and improving recovery. Challenges in dietary recommendations necessitated personalized nutritional counseling for better adherence. Adhering to medical guidelines was vital. Identifying and addressing adherence barriers supported patients in following treatment plans.

Social support helped navigate the healthcare system and offered moral support. Medication adherence, regular monitoring, and timely adjustments were crucial for personalized care. Reporting positive medication outcomes highlighted the importance of clear patient-provider communication regarding treatment expectations. Transportation barriers hindered healthcare access, requiring supportive services. High treatment costs necessitated financial counseling and assistance. The use of MEMS in hospitals enhanced adherence and outcomes. Mobile technology and mHealth interventions significantly improved adherence.

Enhancing medication adherence ensured treatment effectiveness, reduced complications, and improved quality of life. Government policies addressing financial barriers, promoting adherence-focused programs, and national health campaigns improved adherence. Improved adherence led to healthier patients and reduced

healthcare strain, providing clearer insights into treatment efficacy and informing healthcare policies. Integrating MEMS and digital interventions into clinical practice, supported by policies, benefited patients, healthcare systems, and society by addressing adherence comprehensively.

Strength of the Study

The strength of this study lies in its pioneering effort to provide real-world evidence on medication adherence among breast cancer patients in an Asian context. It is the first study to utilize the WHO adherence model, making its findings particularly relevant and tailored to the unique healthcare landscape of Asia. This model helped in accurately identifying patients at risk of non-adherence, allowing for targeted interventions that can significantly improve patient outcomes.

The setting of the study, despite being a tertiary level hospital, is another strength. It provided access to a diverse patient population including lower, middle, and upper-middle-class individuals. This diversity is crucial as it ensures that the findings are more representative of the broader population, capturing a wide range of socio-economic factors that influence medication adherence. The study also integrated advanced technology like Medication Event Monitoring Systems (MEMS) to track adherence in real-time, facilitating early detection of non-adherence and enabling timely interventions. This technological integration underscores the study's innovative approach to addressing medication adherence.

Additionally, the study emphasized the importance of personalized support through mobile health (mHealth) applications. These applications offered reminders, educational materials, and motivational content, enhancing patient engagement and

adherence. The societal benefits of improved adherence, such as fewer relapses, reduced complications, and better quality of life, were highlighted, showcasing the broader impact of the study's findings. Moreover, the role of government policies in supporting adherence through financial aid and awareness programs was emphasized, highlighting the need for systemic support to improve healthcare delivery and patient outcomes.

Limitations of the Study

This study has several limitations that need to be considered when interpreting the results. Firstly, the cross-sectional design limits the ability to establish causal relationships between the identified factors and medication adherence among breast cancer patients. Longitudinal studies would be more effective in determining causality and understanding how adherence behaviors evolve over time. Secondly, the study relied heavily on self-reported data for assessing medication adherence and other variables, which can be subject to recall bias and social desirability bias. Participants may not accurately recall their medication-taking behavior or may report what they believe is expected rather than their true behavior. Utilizing more objective measures such as electronic monitoring devices could enhance the accuracy of adherence data.

Another significant limitation is the study's confined sample size, which was relatively small and limited to breast cancer patients in the northern region of Kerala. This geographic and demographic limitation may restrict the generalizability of the findings to other regions and populations. Future research should include a larger and more diverse sample to increase the generalizability of the results. While socioeconomic factors such as income, education, and access to healthcare were considered, the study

did not comprehensively account for other potential confounding factors such as cultural beliefs and the quality of patient-provider communication. These factors could have a significant impact on medication adherence and should be included in future studies.

Furthermore, the study setting being a semi-governmental tertiary care center limits the generalizability of the findings to other levels of populations and regions. The study also explored the potential of digital interventions in enhancing medication adherence but did not implement or evaluate specific digital intervention programs. Future research should involve the design, implementation, and evaluation of digital interventions to provide more concrete evidence on their effectiveness in improving medication adherence among breast cancer patients.

Future Prospects

The future prospects of this study highlight the need for more comprehensive research to provide concrete evidence on medication adherence and the factors influencing it. Future studies should adopt longitudinal designs to establish causal relationships and better understand how adherence behaviors evolve over time. This approach will help in developing effective interventions tailored to the specific needs of breast cancer patients.

One significant recommendation is the integration of the Medication Event Monitoring System (MEMS) in every hospital. MEMS can provide accurate and real-time data on medication adherence, allowing for timely interventions. Additionally, government policies should be designed to overcome financial and logistic barriers affecting medication adherence. Financial support and logistical arrangements can alleviate

some of the burdens faced by patients, improving their adherence to prescribed treatments.

Developing applications to detect non-adherence early is another promising prospect. These applications can provide personalized reminders, educational content, and motivational support, enhancing patient engagement and adherence. The use of digital health technologies can revolutionize the way adherence is monitored and managed, leading to better treatment outcomes. Furthermore, there is a need for interventions that address cultural beliefs and improve patient-provider communication quality. These factors play a crucial role in medication adherence and should be considered in the design of future interventions.

7. Summary and Conclusion

Summary

This study assessed medication adherence among breast cancer patients in the northern region of Kerala, aiming to improve adherence rates and patient outcomes. The primary objectives included evaluating adherence levels, identifying factors influencing adherence, and exploring the potential of digital interventions. Hypotheses suggested that health literacy, psychological health, social support, treatment regimen complexity, and socioeconomic status significantly impacted adherence. The research questions investigated the relationships between these factors and medication adherence among breast cancer patients.

The literature review highlighted the global burden of breast cancer, with notable disparities in incidence and mortality across regions. GLOBOCAN 2020 reported 19.3

million new cancer cases globally, with breast cancer being the most diagnosed. Studies emphasized the need for enhanced cancer prevention and management strategies, particularly in transitioning countries. Understanding the concepts of "compliance" and "persistence" in medication adherence was crucial. Other studies underscored the impact of literacy, cultural factors, and psychological health on adherence, highlighting the complexity of influencing factors.

The methodology involved a cross-sectional study of women aged 18 and above, diagnosed with breast cancer, and undergoing treatment at oncology clinics in Kerala. Data collection included structured questionnaires and medical record reviews, using tools like the Medication Adherence Rating Scale (MARS) and electronic monitoring devices. Factors examined included socioeconomic status, patient-related factors (age, education, menopausal status, marital status, co morbidities), condition-related factors (tumor size, lymph node involvement, tumor grade), therapy-related factors (treatment complexity, side effects), and health system-related factors (patient-provider communication, access to healthcare services). Statistical analyses, such as logistic regression and ANOVA, identified predictors of medication adherence and examined differences based on patient and treatment characteristics.

Key findings indicated significant challenges in ensuring medication adherence among breast cancer patients. The age distribution showed a majority of cases in women aged 50 and older. Family type did not significantly influence adherence, emphasizing individual factors and support systems. Employment status was impacted by breast cancer diagnosis and treatment. Menstrual changes were common due to hormonal alterations induced by treatment. Family support played a crucial role in treatment

adherence, while the complexity of treatment regimens and financial burdens were significant barriers. Digital interventions and strong familial support were crucial in improving adherence rates.

The study concluded that addressing financial, logistical, and support-related barriers was essential for improving medication adherence among breast cancer patients. Tailored interventions targeting these factors were crucial for enhancing treatment adherence and overall patient well-being. The integration of Medication Event Monitoring Systems (MEMS) and mobile health (mHealth) applications showed promise in enhancing adherence. Government policies should address financial barriers and promote adherence-focused programs. Enhanced adherence led to healthier patients, reduced healthcare costs, and better patient outcomes. This study contributed to the growing evidence that comprehensive strategies addressing adherence benefit patients, healthcare systems, and society at large.

Conclusion

Medication adherence is a complex issue influenced by a multitude of factors, including individual, socioeconomic, and systemic challenges. The study underscores that medication adherence is not exclusively the responsibility of the patients but requires a comprehensive approach to address individual needs, systemic challenges, and cultural considerations. Implementing tailored interventions, leveraging technological advancements, and improving healthcare infrastructure are significant steps towards better treatment outcomes for breast cancer patients in India.

The integration of advanced technologies like MEMS and mHealth applications, alongside robust government policies, can significantly enhance adherence rates.

Addressing financial, logistical, and support-related barriers through targeted interventions is essential for improving patient outcomes. This research contributes valuable insights into developing comprehensive strategies to promote medication adherence, ultimately benefiting patients, healthcare systems, and society at large. By focusing on tailored interventions and leveraging technological advancements, healthcare providers can better support breast cancer patients in adhering to their treatment regimens, thereby improving their quality of life and treatment efficacy

References

1. WHO (World Health Organization): National Cancer Control Programmes: Policies and Managerial Guidelines. 2nd edition. Geneva: WHO; 2002.
2. Haynes RB, McDonald H, Garg AX, Montague P. Interventions for helping patients to follow prescriptions for medications. Cochrane Database Syst Rev. 2002;(2):Cd000011.
3. Kronish IM, Ye S. Adherence to cardiovascular medications: lessons learned and future directions. Prog Cardiovasc Dis. 2013;55(6):590-600
4. Komatsu H, Yagasaki K, Yamaguchi T, Mori A, Kawano H, Minamoto N, et al. Effects of a nurse-led medication self-management programme in women with oral treatments for metastatic breast cancer: A mixed-method randomised controlled trial. European Journal of Oncology Nursing. 2020;47:101780. https://doi.org/ 10.1016/j.ejon.2020.101780.
5. Krok-Schoen JL, Naughton MJ, Young GS, Moon J, Poi M, Melin SA, et al. Increasing Adherence to Adjuvant Hormone Therapy Among Patients With Breast Cancer: A Smart Phone App-Based Pilot Study. Cancer Control. 2019;26:

1073274819883287. doi: 10.1177/1073274819883287.

6. Krousel-Wood M, Craig LS, Peacock E, Zlotnick E, O'Connell S, Bradford D, Shi L, Petty R. Medication adherence: expanding the conceptual framework. American journal of hypertension. 2021 Sep;34(9):895-909.
7. Peacock E , Krousel-Wood M. Adherence to antihypertensive therapy. Med Clin North Am2017; 101:229–245.
8. Santorelli ML, Steinberg MB, Hirshfield KM, Rhoads GG, Bandera EV, Lin Y, Demissie K. Effects of breast cancer on chronic disease medication adherence among older women. Pharmacoepidemiology and drug safety. 2016 Aug;25(8):898-907.
9. Lehrnbecher T, Laws HJ, Boehm A, Dworzak M, Janssen G, Simon A, Groll AH. Compliance with anti-infective preventive measures: A multicentre survey among paediatric oncology patients. European Journal of Cancer. 2008 Sep 1;44(13):1861-5.
10. Al-Hassany L, Kloosterboer SM, Dierckx B, Koch BC. Assessing methods of measuring medication adherence in chronically ill children–a narrative review. Patient preference and adherence. 2019 Jul 22:1175-89.
11. Costa E, Giardini A, Savin M, Menditto E, Lehane E, Laosa O, Pecorelli S, Monaco A, Marengoni A. Interventional tools to improve medication adherence: review of literature. Patient preference and adherence. 2015 Sep 14:1303-14.
12. Foulon V, Schöffski P, Wolter P. Patient adherence to oral anticancer drugs: an emerging issue in modern oncology. Acta Clinica Belgica. 2011 Apr 1;66(2):85-96.
13. Geynisman DM, Wickersham KE. Adherence to targeted oral anticancer

medications. Discovery medicine. 2013 Apr;15(83):231.

14. Shankar SP, Babu IS, Ramya N. A study on usefulness of modified medication adherence scale in assessing adherence among hypertensive patients. Perspectives in Clinical Research. 2019 Oct 1;10(4):163-7.
15. Wilhelmsen NC, Eriksson T. Medication adherence interventions and outcomes: an overview of systematic reviews. European Journal of Hospital Pharmacy. 2019 Jul 1;26(4):187-92.
16. Sankar UV, Lipska K, Mini GK, Sarma PS, Thankappan KR. The adherence to medications in diabetic patients in rural Kerala, India. Asia Pacific Journal of Public Health. 2015 Mar;27(2):NP513-23.
17. Bhandari S, Sarma PS, Thankappan KR. Adherence to antihypertensive treatment and its determinants among urban slum dwellers in Kolkata, India. Asia Pacific Journal of Public Health. 2015 Mar;27(2):NP74-84.
18. Sharma N, Jones M, Dunning T, Holman CD, Preen DB. Interventions for improving medication adherence in patients with multimorbid conditions. J Gen Intern Med. 2023;38(4):759-766.
19. Kumar, J., Gudhoor, M. and Ganachari, M.S., 2020. Parallel assessment of chemotherapy adherence and supportive therapy adherence on occurrence and minimization of adverse drug reactions among cancer patients: a clinical-based observational study. Journal of Pharmacy Technology, 36(2), pp.72-77.
20. Foster JA, Abdolrasulnia M, Doroodchi H, McClure J, Casebeer L. Practice patterns and guideline adherence of medical oncologists in managing patients with early breast cancer. Journal of the National Comprehensive Cancer Network. 2009 Jul 1;7(7):697-706.

e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2023; 15(11); 145-149

Original Research Article

Assessment of Factors Influencing Medication Adherence among Breast Cancer Patients

Reshma V[1], Shahina Khan[2], Prakashiny S[3], Nithyapriya M[4*], Durgesh Kumar[5], Madhuram[6], Uma Shanker[7], NK Warrier[8]

[1]Assistant Professor, Department of Pharmacology, Shri Sathya Sai Medical College and Research Institute, Sri Balaji Vidyapeeth (Deemed to be university), Tamilnadu

[2]Assistant Professor, Department of Bio-Medical Sciences, College of Medicine, King Faisal University, Al Hasa, Saudi Arabia

[3]Associate professor, Department of Pathology, Shri Sathya Sai Medical College and Research Institute, Sri Balaji Vidyapeeth (Deemed to be university), Tamilnadu

[4]Assistant professor, Department of Pharmacology, Government Medical College and ESI Hospital, Coimbatore, under Tamil Nadu Dr MGR Medical University, Chennai

[5]Statistician, KMCT Medical College, Kozhikode, Kerala

[6]Professor and Head, Department of Pharmacology, Shri Sathya Sai Medical College and Research Institute, Sri Balaji Vidyapeeth (Deemed to be university),Tamilnadu

[7]Research Administrator, Aster Medcity, Kochi, Kerala

[8]Medical Director, MVR Research and Cancer Institute, Kozhikode, Kerala

Received: 25-08-2023 / Revised: 28-09-2023 / Accepted: 30-10-2023

Corresponding author: Dr. Nithyapriya M

Conflict of interest: Nil

Abstract:

Introduction: Breast cancer (BC) is a complex tumor that is characterized by different molecular and biological types. Currently, there are therapeutic agents available to treat some variants of breast cancer. However, there is no universally available treatment strategy to manage different types of BC. The major concern, however, is the awareness of BC, its prevalence, awareness of symptoms, treatment and preventive measures, and medication adherence that could potentially contribute to improved quality of life and better outcomes. This study was carried out to assess the knowledge, perception, and practice of medication and identify the factors that affect medication adherence among BC patients.

Methods: This prospective questionnaire-based study was carried out among 51 women who were diagnosed with BC. The subjects were assessed for various factors that influenced adherence. The factors assessed included family type, reaction to the diagnosis, treatment place, co-morbidities, following instructions, who reminded of taking medication, feeling after medication, taking medication while traveling, who was accompanied on follow-up, asking doubts, feeling like stopping treatment due to cost, felt like stopping treatment due to travel constraints, communication from/with the hospital.

Results: Of the total 51 women included in the study, the age was 51.47±11.76 years. More than half (58.2%) of the BC women in this study showed medication adherence. Among the variables assessed for their influence on adherence, feeling after taking medication (p=0.010), medication while traveling (p=0.001), cost associated with medication (p=0.001), and travel-associated factors (p=0.001) significantly influenced medication adherence.

Conclusions: Despite the availability of medication, women diagnosed with BC face several difficulties in following the treatment schedules. Medication adherence was greatly influenced by the positive effects of treatment and the cost associated with treatment and travel.

Keywords: Breast cancer, quality of life, Medication adherence.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Breast cancer (BC) is a cancer of the breast tissue wherein the cells demonstrate abnormal multiplication leading to lumps and tumors. More than half a million deaths were attributed to BC in the year 2020 according to the data available at World Health Organization (WHO). Interestingly, BC appears to show no specific predisposing factors except the age and sex of the affected person. However, some of the factors that could influence the development of BC include obesity, genetic predisposition, mutations in the genes (BRCA1, BRCA2, PALB-2), alcoholism,

Cureus

Open Access Review Article

DOI: 10.7759/cureus.52721

Medication Adherence in Cancer Patients: A Comprehensive Review

Review began 01/12/2024
Review ended 01/16/2024
Published 01/22/2024

© Copyright 2024
V et al. This is an open access article distributed under the terms of the Creative Commons Attribution License CC-BY 4.0., which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Reshma V [1], Arun M. Chacko [2, 3], Naseeha Abdulla [4], Maduram Annamalai [1], Venkataramana Kandi [5]

1. Pharmacology, Shri Sathya Sai Medical College and Research Institute (SSSMCRI), Chennai, IND 2. Biochemistry, Sri Balaji Vidyapeeth, Puducherry, IND 3. Biochemistry, Azeezia Institute of Medical Sciences and Research, Kollam, IND 4. Pharmacology and Therapeutics, Kunhitharuvai Memorial Charitable Trust (KMCT) Medical College, Calicut, IND 5. Clinical Microbiology, Prathima Institute of Medical Sciences, Karimnagar, IND

Corresponding author: Maduram Annamalai, maduramraj@gmail.com

Abstract

Cancer is a complex disease that can affect different parts of the body. The rates of cancer have shown an increasing trend in the past decade. A majority of cancers are detected late, therefore becoming untreatable and resulting in significant mortality. Additionally, the lack of awareness about cancers, their risk factors, diagnostic modalities, and preventive measures contributes to increased burden among people. Despite significant developments in the therapeutic and comprehensive management of cancers, the cause for concern is the lack of medication adherence. This is majorly attributed to the adverse effects of the medication, the cost of the drugs, and other reasons. This review comprehensively discusses various aspects of cancer medication adherence that include therapeutic modalities for treating cancers, factors influencing medication adherence, barriers, and facilitators to medication adherence.

Categories: Public Health, Oncology, Therapeutics
Keywords: risk factors, facilitators to medication adherence, barriers, therapeutic modalities, medication adherence, cancer

Introduction And Background

Globally, cancer is the second leading cause of death after cardiovascular diseases. Cancer accounted for more than 10 million deaths in 2020. Over the next 20 years, it is anticipated that there will be 22 million incidences of the disease every year, up from 14 million in the year 2012 [1-3]. Moreover, there is an increasing trend of cancers caused by the human papillomavirus (HPV) and hepatitis viruses (hepatitis B virus and hepatitis C virus), especially among people residing in low- and low-middle-income countries such as India [1]. The International Agency for Research on Cancer (IARC), a research group headed by the World Health Organization (WHO), suggested cancer causes that include exposure to radiation, chemicals, toxins, and microbes [1]. According to the WHO, identifying risk factors, minimizing the risk, screening, early diagnosis, treatment, and palliative care are essential to reduce the burden of cancer [1]. With an anticipated 2.3 million new cases worldwide in 2020, breast cancer (BC) has surpassed lung cancer as the most frequently diagnosed malignancy [4]. The impact of the obesity epidemic and the mammography screening program, which preferentially finds slow-growing estrogen receptor (ER)-positive tumors, may be blamed for the rise in ER-positive breast cancer, according to the data that are currently available in several different nations [5]. Advanced technologies have resulted in new drug interventions, and these can extend life expectancy by reducing the progression of cancer and sometimes cure the disease, improving the patient's quality of life. Adherence to the treatment advice with adequate measures is a vital part of the cure of the disease [6]. This review comprehensively discusses various aspects of cancer medication adherence, such as therapeutic modalities for treating cancers, factors influencing medication adherence, barriers, and facilitators to medication adherence.

Review

Cancer treatment modalities

Cancer treatment is complex and comprises approaches such as surgery, radiation, and chemotherapy. However, more advanced methodologies such as gene therapy, stem cell therapy (induced pluripotent stem cells, embryonic stem cells, hemopoietic stem cells, neuronal stem cells, and cancer stem cells), monoclonal antibodies, nano-based medicine, ablation (thermal ablation, cryoablation, and radiofrequency ablation), and chemodynamic and ferroptosis-based therapies, along with radiodynamic therapies, radionics, chitosan-based photodynamic therapy, targeted delivery-based therapy modalities using folic acid-conjugated photo-responsive polymeric particles, oncolytic virus-based therapy, and natural antioxidant therapies, have been explored in the cancer treatment. Some of these interventions are at different stages of development, and a few are already being approved and utilized for the treatment of various cancers [7-11]. The anticancer properties of thioredoxin-binding protein (TXNIP) have been investigated for its application to treat cancer [12]. Recently, polymer-directed enzyme prodrug therapy, elastin-like polypeptides, and plasmid deoxyribonucleic acid (DNA) have been suggested as newer treatment options for cancer [13-15].

How to cite this article
V R, Chacko A M, Abdulla N, et al. (January 22, 2024) Medication Adherence in Cancer Patients: A Comprehensive Review. Cureus 16(1): e52721. DOI 10.7759/cureus.52721